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# Network embeddedness in the internationalization of biotechnology entrepreneurs

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## ABSTRACT

This study investigates how entrepreneurs of biotech enterprises embed in domestic and international networks so as to internationalize. We advance a contextual framework of embeddedness of internationalizing entrepreneurs, providing a contribution (i) by synthesizing and applying existing conceptual insights from the networking literature to provide a more culturally sensitive view of getting embedded for international entrepreneurship in the biotech industry and (ii) by adding insights into the practices and (micro)processes of how and in what ways embeddedness integrates with the internationalization of biotech entrepreneurs. Our study involves six entrepreneurs from Canada, Finland, and New Zealand. Context-specific embeddedness was studied by exploring the (i) type, (ii) strength, (iii) locality, and (iv) importance of the international and national network ties among internationalizing entrepreneurs. We found differences in relation to the locality of universities and research institutes, role and type of financiers, and customer focus in internationalization. For instance, while customers were central to the embeddedness of Canadian and New Zealand entrepreneurs, Finnish entrepreneurs had no focus on their customers, but acted solely through sales channels and partners. The customer focus of New Zealand entrepreneurs was mainly international, whereas it was domestic in the case of Canadian entrepreneurs.

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## Introduction

Embeddedness describes the networks (such as the type, depth, and extent of networks) of entrepreneurs in a certain context (Dacin, Ventresca, and Beal 1999; Jack and Anderson 2002). The social context plays an important role in the network development of entrepreneurs (see e.g. Elfring and Hulsink 2003; Hoang and Antoncic 2003; Jack 2005; Jack and Anderson 2002; Lans, Blok, and Gulikers 2015; Slotte-Kock and Coviello 2010). However, we have limited understanding about the influence of the context on networking behaviour and embeddedness of entrepreneurs (Anderson, Dodd, and Jack 2010; Gedajlovic et al. 2013;

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Hoang and Antoncic 2003; Jack 2010; McKeever, Anderson, and Jack 2014; McKeever, Jack, and Anderson 2015). We use the lens of embeddedness by Granovetter (1985) to explore entrepreneurial networking in a multinational context. As Uzzi (1997) notes, even Granovetter's account lacks details of *how and in what ways* embeddedness integrates with entrepreneurs. Hjalager (1989) argued that by focusing on situated roles and relationships, and how these influence action, a more holistic and situated view of entrepreneurship can be generated.

Indeed, context is the sensitizing device that renders insights into how factors may attend to temporal and spatial circumstances (Cappelli and Sherer 1991). It is of crucial importance in entrepreneurship as it is multifaceted, has direct and indirect influences, and can cut across different levels of analysis (Welter 2011). Biotech enterprises are highly suitable for research on contextual international embeddedness due to their knowledge intensive constellations in high velocity environments, whereby strategic stakeholders such as research institutions and venture capitalists interact and embed intensively, forming ties in geographically dispersed countries (Audretsch and Feldman 2003; Whittington, Owen-Smith, and Powell 2009). Thus, the biotech industry is traditionally one of the most networked industries and provides a fruitful context to study embeddedness. As Powell (1998) states, the main aim in this industry is to seek and create new knowledge and technology development, and thus, entrepreneurs collaborate with others to improve their competencies.

To acquire insights into international embeddedness in the biotech industry, we set out to study the embeddedness of six entrepreneurs from different geographical contexts via a theory-building, multiple case study design. The construct of embeddedness allows us to study international networks holistically and to apply and synthesize existing conceptual insights from the literature, and to conduct studies on internationalizing entrepreneurs in three different cultural contexts. Indeed, internationalization is about embedding in the context of a foreign country. The extant literature, for example, by Bourdieu (1980) and Bourdieu and Wacquant (1992) explain this process through the concepts of building social capital and accepting aspects of the foreign country habitus (beliefs about a culture), when increasing their insidership positions in the country.

We examined two entrepreneurs from Canada, Finland and New Zealand each, and applied a multitude of network perspectives, namely (i) type, (ii) strength, (iii) locality and (iv) importance of network ties to holistically embrace the embeddedness of the case entrepreneurs. The data allows us to acquire insights into the ways in which international networking processes occur, and provides a more nuanced understanding of how the goals in international networking are achieved. We posed the following question: *How and to whom do entrepreneurs get embedded during their early internationalization?*

The contributions of this paper lie in (i) synthesizing and applying existing conceptual insights from the literature to provide a more culturally sensitive view of getting embedded for international entrepreneurship in the biotech industry, and (ii) adding insights into the (micro)processes and practices, i.e. how and in what ways embeddedness integrates with the internationalization of biotech entrepreneurs. The study of networking practices in various cultural contexts allows us to understand the social dynamics of internationalization, and the combinations of types, localities, strengths and importance of networks permits us to grasp more clearly the networking nuances involved in achieving the goals in internationalization.

We discovered that the case entrepreneurs were embedded in similar types of networks (universities and research institutes, customers, sales channels and partners, and financiers), some of them domestic while others international, facilitating the acquisition of resources to assist them in their internationalization efforts. Their importance, strength, and locality showed both similarities and differences in relation to the three national contexts under study. Hence, the context shaped all three approaches observed in our study. This finding emphasizes the role of culture and market size in international networking and internationalization. However, we are in the very early stages of understanding the true complexity of the relationship between entrepreneurship and context.

This paper is structured as follows. The next section presents the theoretical background to our study. This is followed by the methodology employed and the findings relating to the four aspects of interest. The paper ends with a discussion section, and implications for research and management.

## Theoretical background

### *Entrepreneurship and internationalization*

In their definition of entrepreneurship, Shane and Venkataraman (2000, 218) consider it to be 'the scholarly examination of how, *by whom*, and with what effects opportunities to create future goods and services are discovered, evaluated and exploited' (see also Venkataraman 1997). In the foreign marketplace context, international entrepreneurship refers to 'the discovery, enactment, evaluation and exploitation of opportunities – across national borders – to create future goods and services ... Actors (organizations, groups, or individuals) who discover, enact, evaluate, or exploit opportunities to create future goods or services and who cross national borders to do so are internationally entrepreneurial actors'. (Oviatt and McDougall 2005, 540). Internationalization concerns the possibility of conducting exchange with new foreign partners (Ellis 2011). Exchanges can be conducted with customers, distributors, licensees, franchisees, contract manufacturers, or joint venture partners (Ellis 2011). The importance of network ties for internationalization and the need to understand them in-depth has been increasingly emphasized both in international entrepreneurship (e.g. Covin and Miller 2014; Ellis 2011; Jones, Coviello, and Tang 2011; Oviatt and McDougall 1994; Tolstoy 2010) and international business (e.g. Johanson and Vahlne 2009).

Johanson and Vahlne (2009) consider internationalization to be an outcome of network positioning in the foreign market. As they state, '[a]nything that happens, happens within the context of a relationship, and a firm that is well established in a relevant network or networks is an "insider"' (2009, 5). This process of embedding in a foreign country context, is captured by Bourdieu (1980) and Bourdieu and Wacquant (1992) through the concepts of building social capital and accepting aspects of the foreign country habitus, when building increasing degrees of insidership positions. In this section, we review the literature that is relevant to our embeddedness themes concerning the types of networks that internationalizing entrepreneurs use, and the strength, locality and importance of network ties.

## ***Networks and embeddedness***

### ***Type of networks***

The term network is used in several ways in order to represent connections between actors that can be individuals or organizations (Coviello and Cox 2006; Slotte-Kock and Coviello 2010). Network theory has its origins in sociology, but later it developed into three different network approaches due to dissimilar contexts and disparate continents, namely business, social and entrepreneurial network approaches.

The business network approach concentrates on network ties relating to other organizations (e.g. Johanson and Vahlne 2009; Sharma and Blomstermo 2003). In this context, enterprises are often involved in many other business relationships, i.e. they operate in networks of connected relationships (cf. Anderson, Hakansson, and Johanson 1994). These connected relationships are labelled 'business networks', and the term 'connected' implies that exchange in one relationship is linked to exchange in another. As they become more connected and interdependent, these enterprises adapt and combine their resources to create new knowledge, allowing them to develop new products and new markets. As Forsgren, Holm, and Johanson (2015) explain, Johanson and Vahlne's (2009) network model is influenced by network research using the social exchange theory of Cook and Emerson (1978) and the network embeddedness concepts of Granovetter (1985). An important argument in Johanson and Vahlne's network model is that in order to be successful, it is important to overcome the liability of outsidership and become embedded in a relevant network to become an insider. This echoes a similar perspective expressed by Ciravegna, Majano, and Zhan (2014), who found that enterprises that proactively identify their initial clients in international networks may internationalize more quickly and thoroughly.

Studies on entrepreneurial networks have emphasized the importance of social networks (Ellis 2011; Jack and Anderson 2002; Keupp and Gassmann 2009; Slotte-Kock and Coviello 2010). We apply this approach here, as it stresses the network ties possessed by entrepreneurs. Ellis (2011) noted that research using the network model of internationalization had shed light on the interaction between organizations, but important social exchanges at the level of the individual entrepreneur had been ignored. The inclusion of social networks when investigating networks of enterprises is important because entrepreneurship is situated within a social context and involves social interactions that influence how entrepreneurs consider opportunities and access resources (McKeever, Anderson, and Jack 2014; Ozgen and Baron 2007). Networking practices allow us to understand the social dynamics of internationalization and the emphasis on type, locality, strength and importance of networks permits us to see more clearly the approaches that entrepreneurs assume to achieve their internationalization goals. Jack and Anderson (2002) highlight how entrepreneurs embed themselves in social networks through actions such as fundraising for community projects, social club membership, or attendance of social functions that provide entrepreneurs with access to previously unattainable resources and assist them in bridging structural holes. Several studies have shown that both prior business networks (e.g. clients, suppliers, and supporting institutions) and social networks (e.g. friends, family, and former clients) influence the internationalization process in enterprises because they assist entrepreneurs in finding foreign market opportunities (Ellis 2011; Evers and O'Gorman 2011; Keupp and Gassmann 2009).

### ***Strength of network ties***

The strength of a network tie can be considered from a number of perspectives, including closeness (Marsden and Campbell 1984), trust (Elg 2008; Jack 2005; Morgan and Hunt 1994; Singh 2000), mutual respect (Jack 2005) and commitment (Hite 2003; Morgan and Hunt 1994). According to Granovetter (1973), the strength of a tie is viewed as a combination of time, emotional intensity and intimacy, and reciprocal services that characterize the tie. As pointed out by Marsden and Campbell (1984), the use of frequency and duration as a measure of the strength of a tie can be misleading, and hence, these notions are not applied here. Using a modification of the definition provided by Söderqvist and Chetty (2013), in this study, a strong tie is defined as one that is close, and which is based on trust, mutual respect, and commitment. In contrast, a weak tie is 'a superficial tie not yet based on strong trust and where the parties do not know each other well and are not emotionally close to each other' (Söderqvist and Chetty 2013, 539).

Existing network ties have great value for entrepreneurs in the form of social capital (Bourdieu 1980). Bourdieu and Wacquant (1992, 119) define social capital as 'the sum of the resources, actual or virtual, that accrue to an individual or a group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition'. The extent of an individual's social capital depends on the extensiveness of their network, and on how much social capital each of these network ties possesses (Bourdieu 1980). Bourdieu (1980) also notes that work and effort is needed to maintain and develop these ties in order to become or remain strong.

### ***Locality of network ties***

The location of the network tie can influence the enterprise's internationalization efforts (Andersson, Evers, and Griot 2013; Boehe 2013; Milanov and Fernhaber 2014). Network ties may be distinguished into domestic or international ties, yet much of the extant literature covers solely international network ties (Andersson, Evers, and Griot 2013; Milanov and Fernhaber 2014). The enterprise's domestic network ties that have top management international experience and partnerships in foreign markets provide a foundation for the enterprise to gain knowledge about internationalization (Andersson, Evers, and Griot 2013; Milanov and Fernhaber 2014). By collaborating with these domestic entrepreneurs with international experience, small entrepreneurs can compensate for their own lack of international experience and enter new networks to facilitate their internationalization. Hence, entrepreneurs gain networking skills from their domestic network ties, including how to build and maintain these ties, before forming international network ties that are more complex. Some entrepreneurs enter foreign markets because they gain knowledge by following their domestic customers with international experience into foreign markets (Sharma and Blomstermo 2003). Enterprises with high levels of internationalization do not necessarily replace domestic ties with international ties, and tend to have domestic ties for inter-industry and research collaboration, as Keeble et al. (1998) found in their study of technology-intensive small firms. Domestic network ties are a source of raising finance to fund the enterprise's internationalization, and the diversity of these network ties has a positive influence on the enterprise's internationalization success (Manolova, Manev, and Gyoshev 2014). A domestic network tie is, however, not always beneficial for the small entrepreneur in its internationalization efforts, as large domestic partners that are focused on the domestic market can stifle internationalization (Boehe 2013; Milanov and Fernhaber 2014). It may also take longer

to learn about internationalization because they need to unlearn old routines from their domestic network ties to learn new routines from their international network ties (Sharma and Blomstermo 2003).

The features of the enterprise's international network ties determine how fast the enterprise will internationalize (Andersson, Evers, and Griot 2013; Oviatt and McDougall 2005). The literature on rapidly internationalizing enterprises indicates that they tend to have existing international network ties that provide them with knowledge and resources to expedite the process (e.g. Oviatt and McDougall 2005; Sharma and Blomstermo 2003). In their studies of geographical proximity and networking, Andreosso-O'Callaghan and Lenihan (2008) and Andersson, Evers, and Griot (2013) have found that the enterprise's international network ties were more useful than those in the domestic market.

### ***Importance of network ties***

Although there is little financial investment in network ties, they provide access to resources that enhance the success and competitive advantage of enterprises (Prashantham and Dhanaraj 2010; Slotte-Kock and Coviello 2010). As entrepreneurs become more embedded, they interact with their network partners, and turn out to be more aware of each other's capabilities and resources and how these can be combined to develop new knowledge or enter new foreign markets (Agndal and Chetty 2007; Johanson and Vahlne 2009). The reputation of their network ties provides enterprises with credibility that enables them to gain access to new networks and valuable resources (Stinchcombe 1965; Zimmerman and Zeitz 2002). By embedding themselves in various networks, these entrepreneurs acquire valuable resources such as technology and information about new opportunities and market knowledge (Elfring and Hulsink 2003; Johanson and Vahlne 2009; Partanen, Chetty, and Rajala 2011; Powell 1998).

Embeddedness enables customer feedback for the enterprise to improve or adapt its products for specific foreign markets. Entrepreneurs form network ties to gain financial resources to fund their internationalization growth (Le and Nguyen 2009; Manolova, Manev, and Gyoshev 2014). They also establish ties with universities and research institutes to improve their technological knowledge and develop new products (Audretsch and Feldman 2003; Maurer and Ebers 2006; Partanen, Chetty, and Rajala 2011; Powell 1998).

## **Methodology**

### ***Research design and case selection***

We examine embeddedness based on a multiple case study design (Eisenhardt 1989; Eisenhardt and Graebner 2007). In line with Eisenhardt and Graebner (2007: 27), we believe that 'theory building from multiple cases typically yields more robust, generalizable, and testable theory than single-case research'. Our research design was one that made it possible to study a complex phenomenon that could not be separated from its context (cf. Bonoma 1985). The biotechnology industry displays such complexity, being a knowledge and research-based industry, that it is highly relationship-dependent (e.g. Al-Laham and Souitaris 2008). In our study, two entrepreneurs were selected from each country, namely Canada, New Zealand, and Finland. By including three countries we address a gap in the international entrepreneurship literature reported by Terjesen, Hessels, and Li (2016) in their review of the



comparative international entrepreneurship literature. They state that while this research is important and has considerable capacity to develop international entrepreneurship research, the extant studies are scant with 'limited theoretical insights' (300). Hence, they assert the need for multi-country studies, since '[a]n appreciation of similarities as well as fundamental differences enables scholars to develop better theories to explain conditions that help or hinder entrepreneurial activity in different countries as well as the implications of entrepreneurship' (301). In a similar vein, the international entrepreneurship literature acknowledges that the geographical location of internationalizing entrepreneurs largely dictates their foreign sales ratios and the number of countries in which they internationalize (Zander, McDougall-Covin, and Rose 2015). It could be that the domestic base of the entrepreneurs affects how they embed themselves in networks.

The criteria for inclusion involved purposeful selection. To be eligible as a case entrepreneur, the following criteria had to be met: the enterprise (i) had to be from Canada, New Zealand, or Finland; (ii) have fewer than twenty employees since we sought to capture small ventures; (iii) belong to the biotechnology industry that is characterized by high competition, volatility and intensive networking behaviour; (iv) have some international cooperation (due to long product development processes, enterprises could have relatively few sales abroad, though their international cooperation may nevertheless be strong); (v) be less than twenty years old. The variation in the dates of establishment of the enterprises provide a comprehensive picture of embedding practices in both very young and more mature entrepreneurs. Since this study involves a small sample of cases, it is appropriate to include diversity to increase the quality of the emerging findings (Schweizer 2005). The diverse cases provide a rich data-set to examine how entrepreneurs engage in different activities and to examine the processes involved in embedding themselves in networks during the internationalization process. In addition, diverse cases make it simple to recognize contrasting patterns in the entrepreneurs' types of relationships, network dynamics and the significance of the context involved. As Eisenhardt and Graebner (2007) suggest, a variety of cases enable researchers to recognize an 'unusual phenomenon' (27) and clear patterns in the data, and to replicate them across multiple research sites.

Consequently, in our selection of cases we aimed for 'polar types' (Eisenhardt and Graebner 2007, 27) so that we could observe contrasting findings in the data. While the three countries are from different geographic locations, they have some similarities and differences in their business and cultural environments, and sizes of their domestic markets. The diverse country contexts may influence the activities entrepreneurs engage in to embed themselves in relevant networks to internationalize. As Birley (1985) recognized, we need more research from other social and cultural contexts to understand the types and effectiveness of networks to help businesses. Finland and New Zealand are small open economies with less than 5.5 million inhabitants, while Canada is larger with approximately 35 million inhabitants. The successful internationalization of enterprises from small open economies is critical for their growth because of their insignificant domestic market (Casey and Hamilton 2014). While Canada and New Zealand have English as the dominant language and are culturally diverse, Finland is culturally homogenous with Finnish being the dominant language. Table 1 summarizes the key information on the case entrepreneurs. The enterprises were established between 1993 and 2011. The number of employees ranged from one to 14.



**Table 1.** Information on the enterprises.

	Number of employees	Year of establishment	Industry segment	Current ownership base
CAN 1	1	2011	Biogas handling	Government funds
CAN 2	12	1994	Digital pathology	Venture capitalists
FIN 1	12	2001	Regenerative medicine	Venture capitalists
FIN 2	10	2008	Regenerative medicine	Private ownership
NZ 1	14	1993	Veterinary diagnostics	Private ownership
NZ 2	10	2008	Regenerative medicine	Venture capitalists

### **Data collection**

Multiple sources of information were used to collect data from each case entrepreneur. The main form of data collection was interviewing, conducted with the entrepreneurs by one or two interviewers. We conducted 12 interviews with the six entrepreneurs of the enterprises in the three countries in 2012 (first round) and in 2013 (second round). The second round was executed to follow up with the evolution of networks in the enterprises and to complement the data collected during 2012 by asking more detailed questions about the importance of certain network ties. The first round of interviews was conducted face-to-face, except for one Skype interview. The second round of interviews was based on Skype interviewing and/or email exchange. In addition, we obtained secondary material such as information from web pages, annual reports, financial records, minutes of meetings and brochures about each enterprise. The secondary material was used to understand the history and the products of each enterprise to form detailed case histories and understand the circumstances behind critical events, with particular reference to international network partners. The secondary material was also used to triangulate with the information given by the informants.

In line with Svendsen (2006), at the beginning of the interview neutral and non-threatening questions were asked to establish a relationship of mutual trust. The interviewees were first asked to describe their business in general, and were subsequently questioned more specifically about their founding background, their internationalization process and their domestic and international network ties. The interviews lasted from 45 to 90 min. During the interviews, when respondents mentioned events of interest, we asked them probing questions such as 'Could you describe this? How? Why?' to allow the researcher to go deeper into the topic. These questions were developed according to the guidelines issued by Yin (1994), with the aim of making the questions as open as possible. Because the interviews focused on the entrepreneurs' past experiences, we followed the guidelines for retrospective studies by Miller, Cardinal, and Glick (1997), and Huber and Power (1985).

All interviews were digitally recorded, and transcribed verbatim using a word processor. During the second round of listening to the digital recorder, the accuracy of the recorded and transcribed data was checked. The complete transcripts were sent to the interviewees, and any inaccuracies they noticed were corrected based on their comments. In addition, email communication was used to collect further information from the interviewees and clarify inconsistent issues, if necessary.

### **Data analysis**

The analysis of the case data involved three concurrent flows of activity (Miles and Huberman 1994): (i) data reduction, (ii) data displays, and (iii) conclusion drawing/verification. In (i) data

reduction, the data were simplified by writing a detailed case history of each entrepreneur. This was consistent with Pettigrew (1990), who suggests that consolidating disjointed pieces of information chronologically assists in recognizing how episodes connect. The unique patterns of each case were subsequently identified and categorized within patterns related to subtopics derived from the research questions. In addition, checklists and event listings were used to identify critical factors related to the phenomena encountered (Miles and Huberman 1994). In (ii) data display, the relevant data were collected in matrices, graphs, charts, relationships and Microsoft Excel tables. At the (iii) conclusion drawing and verification stage, we concentrated on identifying the aspects that appeared to have significance. At this stage, we noted regularities, patterns, and explanations relating to the networking behaviour and to the phases and qualities of the organizational mechanisms practiced by the entrepreneurs.

## Findings

### *Internationalization context among the case entrepreneurs*

CAN1 was established in 2011. The business concentrates on reusing desulphurized biowaste. The business idea was based on the results of a research group in a Canadian university. CAN1 has one customer in Canada, whose premises are also used as a demonstration plant for the enterprise to assure financiers and new customers. At the time of the interviews, CAN1 was in the early phases of its internationalization, having potential partners and ongoing negotiations in the German and US markets. The entrepreneur of CAN1 considers internationalization a necessity given that the domestic market is too competitive due to its limited size.

CAN2 was established in 1994. It is a global leader in providing digital pathology imaging solutions for research and educational purposes in various environments. Although the first actual international sale occurred in 2006, international cooperation was undertaken right from the company's inception. The need to immediately go international was regarded as self-evident to CAN2's entrepreneur, as the product was niche-oriented. Currently, CAN2 has operations in the USA, Europe, and Canada. At the time of the interviews, CAN2 concentrated strongly on creating adequate financial resources. It thus sought the capability to conduct strategic measures for further internationalization, and establish and strengthen international sales channels and partnerships.

FIN1 was established in 2009. It is a niche-oriented enterprise concentrating on bone substitutes. During the 1980s, two university professors started developing the technology that provided the foundation for the enterprise's products. The product was used in two enterprises between 1996 and 2008, but FIN1's entrepreneur bought the rights to the product in 2009, establishing the enterprise at the same time. FIN1's entrepreneur had gained some good network ties through his experience working for other enterprises in Finland. International sales growth was about 30 per cent annually at the time of the interviews. Currently, FIN1 has thirty international distributors. Given the company had just two distributors in 2009, the growth has averaged seven new distributors each year. The most important foreign markets were the U.S.A., Italy, and Germany. International sales started from Germany and Italy, then moved to the U.S.A., Brazil and Malaysia. Only a few international distributors were found by the entrepreneur's independent searches, whereas most were found by the

entrepreneur asking for recommendations from existing distributors. The distributors have been trained to sell by the entrepreneur. The proportion of foreign sales to total is about 80%. FIN1's interviewee noted that as the Finnish market was very limited in size, internationalization was a necessity.

FIN2 was co-founded by three entrepreneurs in 2001. One of the co-founders is German, who provided good international network ties in the German market from the beginning. It is a niche-oriented enterprise, which develops materials and implants for mending bones in cases of fracture. The idea was based on the increasing need for the treatment of osteoporosis. The entrepreneurs and other people working for the enterprise had known each other for a long time, as they had worked together for another enterprise. As a group, they had developed a wide range of network ties, which facilitated the company's immediate internationalization. The small Finnish market induced FIN2 to internationalize. The enterprise entered Germany within two years from inception, facilitated by the excellent networks of the German co-founder. Germany is still the main market accounting for most of FIN2's international sales. Switzerland and Italy are also important markets and there had been trial exports to several other international markets too.

NZ1 has been operating in veterinary diagnostics since 1994. It employs 14 people and sells in several countries in Asia and Europe. The entrepreneur started international sales in 1996 by establishing a sales subsidiary in the U.K. for European sales. However, the subsidiary had to shut down in 2001 following the foot-and-mouth outbreak. The entrepreneur has subsequently reformulated his strategy, first towards agencies and then towards partnerships. The international sales of NZ1 are currently handled by a domestic distributor with international networks. However, NZ1 took direct feedback from its end customers, i.e. farmers using their tests. NZ1 took part in EU research projects whenever it was invited to join them.

NZ2 was established in 2008. The enterprise operates in the domain of human tissue repair. It achieved its first international sales in 2010, and currently employs ten people. Due to the lengthy approval processes in the U.S., the launching of sales had taken several years. Its main target markets were the U.S.A. and Europe, but the focus was first on the U.S.A. and only very recently were some initial distributor networks in Europe developed. NZ2 looked for customer feedback through its international sales channels.

### ***Type of network ties***

Based on our data analysis, we found out that the entrepreneurs were embedded in four major types of networks, namely (i) universities and research institutes, (ii) customers, (iii) sales channels and partners, and (iv) financiers. Table 2 below illustrates the types of networks and their strength, location and importance.

To begin with, the entrepreneurs were embedded in networks with universities and research institutes. They were the means of setting up research and development in most case enterprises (except for NZ1, the entrepreneur of which started such collaboration only at a later stage). For instance, CAN2 was founded based on an innovation by three university professors, who wanted to discover superior technology for digital pathology and improve the technology constantly. One of FIN2's entrepreneurs explained that the enterprise was also an outcome of a research project: 'This is a university spin-off. [...] We have very good relationships with both domestic and international universities which constantly test and



**Table 2.** Type, strength, location and importance of various network ties with illustrative quotes and descriptions for getting internationally embedded among biotech entrepreneurs.

Type	Strength Location	CAN1	CAN2	FIN1	FIN2	NZ1	NZ2
Universities/research institutes	Importance Description/illustrative quote	Strong Domestic Important 'For the most part it was my professor, and I who came up with this idea together.'	Strong Domestic Important The enterprise was founded based on an innovation by three university professors. Cooperation with universities had been intense ever since.	Strong Domestic and international Important 'We have had constant cooperation with universities [domestic and international] throughout our history.'	Strong Domestic and international Important 'This is a university spin-off. We had a public project with some companies, and the intellectual property of this project to come to them directly.'	Strong Domestic and international Important 'We had some European researchers who published in the European media about this world-leading technology used here. [...] After some other breakthroughs, we got asked to join a large EU research project and we got huge relationships value and credibility out of that.'	Strong Domestic and international Important The founder was a vet who recognized the need for the product. Initially he did the clinical study in the U.S. in partnership with a surgeon based there.
	Strength Location Importance Description/illustrative quote	Strong Domestic Important 'The guy who runs that plant has been very open to talking with me and sort of telling me from a customer perspective what they'd like to see.'	Strong Domestic Important 'You don't design something that expensive without having the customer in the design room.'	Weak International Not important Has not been in contact with end-customers. They react solely to the offers by their sales people, and to some unsolicited orders from customers who approach them directly.	Weak International Not important Was barely in contact with its customers, but responds to unsolicited orders, and has mainly inquired about issues via its partners.	Strong Domestic Important 'I started the business from the user-end [farmers]. We have also branched out, and it is on the website, we have developed a mobile conferencing hub ...'	Weak International Important Was in contact with the customers only via resellers.

(Continued)

Table 2. (Continued)

Type		CAN1	CAN2	FIN1	FIN2	NZ1	NZ2
Sales channels and partners	Strength Location	Weak Domestic	Strong Domestic and international	Strong Domestic and international	Strong Domestic and international	Strong Domestic	Weak International
	Importance Description/ illustrative quote	Not important Was selling directly to customers, and has only had very initial discussions with some international sales channels.	Important Had strong existing business relationships from a previous business, and used them to build sales channels and partnerships in the current business.	Important 'I go to meet customers with them [distributors], train them, and show with my own example how to sell.'	Important 'To begin with, we had some strong distributors ... These distributors, who have worked for ten to twenty years in the market, then know other distributors in other countries. So, I use the current network to find new networks.'	Important 'By going and working with meat processors and milk processors, we have largely pioneered a new route to market [both domestic and international] ... They recommend us [as an option for] healthier milk and meat products.'	Important 'Finding and getting embedded [with] suitable international partners [in the U.S.A] in the first place has taken a lot of effort ... We worked really hard to develop the product in such a way that the partners got involved.'
Financiers	Strength Location	Weak Domestic	Weak Domestic	Strong Domestic	Weak Domestic and international	Weak and strong Domestic	Weak Domestic
	Importance Description/ illustrative quote	Important 'I am constantly applying for new government funds. It takes a lot of time, but has of course made it possible to launch the enterprise.'	Important 'It has been so difficult to get an appropriate financing base, since the venture capitalists have not invested in us. We have lost a lot of time ... to compete with the best available technology which none of our competitors have.'	Important Privately owned and less reliant on financiers. The entrepreneur's father is the main investor.	Important 'It all started by involving suitable financiers from our previous networks. We are totally managed by the investors.'	Important 'We sold the enterprise [privately owned] for a lot of money – to the corporate. [...] That killed off a lot of the sales relationships – because we were with them, none of the other retail businesses in the industry would work with us. We then collected a bunch of private investors and bought the enterprise back.'	Important Had a good finance background and excellent networks. Thus, did not need to struggle with financing.

develop our technology. We have ongoing projects in Austria, Germany, Italy, and Switzerland among others.' They collaborated with the universities to indicate the quality of the enterprise (Audretsch and Stephan 1996) and for constant product development. For all the case entrepreneurs, the cooperation enabled the universities to measure the positive influence of their product on, for example, the pace of healing among patients (FIN1 and FIN2), or on the product's improvements in the accuracy and speed of diagnosing tissue structures (CAN2).

As stated above, the entrepreneurs were also embedded in networks with research institutions other than universities (FIN1) and in EU-level research projects (NZ1) to develop clinical trust and build the brand. As an example, FIN1's entrepreneur mentioned the value of cooperating with the President of the European Bone and Joint Infection Society, emphasizing the indirect beneficial effects of this network tie and spreading news about the products: 'He has operated on 24 patients and presented the positive results around the world. That is exactly the way to get our message to the world, when a very high-level guy presents his extremely positive results'.

The entrepreneurs of CAN1, CAN2, NZ1 and NZ2 focused on customers. The entrepreneurs in FIN1 and FIN2 were very different from the other enterprises and were barely in contact with their customers, but only responded to unsolicited orders and mainly inquired about issues through their sales channels and partners, explained by one of FIN2's entrepreneurs as follows: 'We operate via sales channels, and not directly with the end-customers. Of course, we provide [them] with a reply when they contact us, but we mainly direct them to our sales channels'.

Sales channels and partnerships were to some extent present in the sales procedures of all the entrepreneurs, but were most essential for FIN1 and FIN2, who, as mentioned, were barely in contact with their end customers. In the case of FIN2, the selection of partner companies was the first step after deciding to launch the business following a successful research project: 'After the project, it all began in such a way that we started looking for suitable partner companies and financiers from our earlier networks to base our growth on'.

All entrepreneurs were strongly embedded in networks with financiers, but the structure of ownership dictated to what extent the financiers influenced their everyday actions. Since FIN2 was family-owned, all actions were self-initiated, but in the case of the other entrepreneurs there was, at least at some stage, a phase of more intensive searching for financiers and concern about the lack of them. NZ2's entrepreneur, however, had no financial concerns as he benefited from the strong networks he already possessed. Indeed, one of the biggest challenges facing the biotechnology industry is financing, because of the amount of investment required for product development. The entrepreneurs of CAN1, CAN2, FIN2, and NZ1 were highly active in creating embeddedness with financiers, mainly venture capitalists, but in the case of CAN1, it was mainly government funds due to the firm's very early stage of existence. These firms' entrepreneurs felt they were constantly living on the edge since they were vulnerable if they ran out of product development money. Both entrepreneurs of CAN1 and CAN2 made huge efforts to get an appropriate base of financing from venture capitalists and government funds. One of FIN2's entrepreneurs explained their relationship with financiers:

It has been a surprise for me how the difficulty of getting finances dictates everything we are doing. It even affects our relationships, since you cannot travel if you have a limited budget. Then also our customers, i.e. surgeons, use our product the way they like. We have designed it

for something, but they use it for something else. So, our product also changes according to our end-users, although we would not actually want that.

### ***Strength of network ties***

When discussing the strength of ties during the interviews, we presented the basic definitions for a strong and weak tie by Söderqvist and Chetty (2013, 539): a strong tie is defined as one which is close, and which is based on trust, mutual respect, and commitment, and a weak tie is 'a superficial tie not yet based on strong trust and where the parties do not know each other well and are not emotionally close to each other'.

All entrepreneurs except NZ1 had mainly strong ties with the local universities with whom they cooperated. The network ties to international universities were, however, initially weak in the case of FIN1 and FIN2, but became strong with time. The entrepreneurs in the Canadian and New Zealand enterprises created stronger ties with (potential) customers than their Finnish counterparts achieved by asking for feedback about their product. The Finnish entrepreneurs had solely weak ties with customers since they were not mainly in direct contact with them, and rather operated through sales channels and partnerships. However, the entrepreneur of NZ2 mainly approached its customers together with potential partners and resellers, and the strength of its relationship with international customers was not as high as for the entrepreneurs of NZ1, CAN1 and CAN2, but was constantly strengthening through regular meetings and collaboration. As an example, the entrepreneur of CAN2 gave out the product for free trials in order to obtain feedback on the product. CAN2's entrepreneur explained:

I am a big advocate for getting something in front of somebody really quickly, and not developing it in the lab till we think we have got it right, and taking it to someone. They liked it, they had everything they wanted, they were much more forgiving on everything else, but at the same time they were also committed right away vs. us pushing it.

Regarding the strength of ties with sales channels and partnerships among the entrepreneurs, both strong (CAN2, FIN1, FIN2, NZ1) and weak ties (CAN1, NZ2) were reported. The entrepreneurs of CAN2, FIN1 and FIN2 were able to use strong ties from the enterprises' inception onwards based on their existing network ties they had gained from earlier jobs and enterprises. CAN2's entrepreneur emphasized that the existence of strong earlier sales channels allowed them to concentrate on other issues: 'Sales channels are something we did not need to think about since we had so many strong connections from our earlier business networks. We just started thinking how we will make it work best in our cooperation'.

Strong ties were the majority, especially with the domestic market sales channels and partnerships, except for those of CAN1's entrepreneur, who was still slowly developing ties to domestic sales channels, and had hardly spoken to international sales channels partly because the enterprise was in such an early phase. The strength of ties with financiers varied. Only FIN1's entrepreneur, whose enterprise is 100% family-owned, had constantly strong network ties with financiers. Among the entrepreneurs of CAN1, CAN2, FIN2, NZ1 and NZ2, the relationship with financiers was generally weak. The entrepreneurs of these firms suffered considerably because they were short of adequate resources for research and development and internationalization and, in addition, were asked to strategically follow a certain direction



by the financiers. The lack of financing had actually prevented the entrepreneur of CAN2 from developing the way they would have wished:

We have lost so much because of the difficulty to arrange financing. We were ahead of the curve five-six years ago, with no money. Now we are playing catch-up, but thankfully we have a good technology base that we know we can actually not only come close [to] but also bypass rivals by far.

These accounts from entrepreneurs provide evidence that financiers can be enabling as well as constraining.

Although FIN2's co-founders had found adequate financiers from their earlier networks and partners, the German co-founder did not appreciate the degree to which financiers influenced their strategy: 'Strong networks from the previous business and close control by financiers instructed who was chosen as sales channels and partners. The partners who got involved dictated how we went on with our strategy'.

However, FIN2's co-founders recognized that they could leverage off their existing strong relationships to convince financiers that the enterprise was a solid investment:

We have used them (our existing subsidiary managers, surgeons) as a means of getting financing. We have been able to tell our partners that we have a trustworthy sales channel in a certain country. Or, that we have a trustworthy person who sold this or that much during our time in the earlier enterprise. Hence, we do not need to make mistakes, since we have them [network ties] from the earlier enterprise.

### ***Locality of network ties***

Among the entrepreneurs of FIN1, FIN2, NZ1 and NZ2, the network ties with universities and research institutes were based on both domestic and international universities and research institutes, whereas the entrepreneurs of CAN1 and CAN2 solely relied on local universities. The international focus therefore varied among the entrepreneurs: the entrepreneurs of FIN1, FIN2, NZ2 and ultimately also the entrepreneur of NZ1 had strong research collaboration both in international and domestic locations, whereas those of CAN1 and CAN2 never changed their collaboration with universities and research institutes in the international context. As regards embeddedness with domestic and international customers, there were quite different focuses among the entrepreneurs. The entrepreneurs of CAN1 and CAN2 had a strong focus on involving domestic end-customers with whom they had strong relationships from the early stages of the enterprises onwards. The entrepreneurs of NZ1 and NZ2, on the contrary, paid clear attention to international customers. NZ2's entrepreneur had travelled to the U.S. in the pre-launch phase of the enterprise, indicating a totally international customer focus. NZ1's entrepreneur originally based the whole business idea on the needs of the domestic customers with whom he had a strong relationship, but after gaining networks to Europe, he also started listening to the views of international customers, significantly changing the strategy of the enterprise.

As mentioned, the entrepreneurs of FIN1 and FIN2 differed considerably from the New Zealand and Canadian entrepreneurs in relation to their customer focus because they did not include any customers, either domestic or international. Rather, they met customers only when the customers contacted them, or when they went to meet their international customers together with their agents. It could thus be surmised that the entrepreneurs of these two firms were less customer-oriented than the others.

In relation to the locality of sales channels and partners, the entrepreneur of NZ1 was only involved with domestic sales channels and partners who also mediated their sales abroad. NZ2's entrepreneur, on the contrary, was only involved with solely international sales channels and partners. He immediately started creating international partners after the inception of the enterprise, since the domestic market was too small for sizable sales. Furthermore, NZ2's was the only entrepreneur who had solely international sales channels in the early phase of the enterprise. All the remaining entrepreneurs (CAN1, CAN2, FIN1, FIN2) had their own, both domestic and international, sales channels.

Interestingly, in relation to the nationality of the financiers, only the entrepreneurs of FIN2 had both domestic and international financiers. They had used their existing network portfolio from earlier enterprises as a lever to attract funding. However, the international financiers were determined that the enterprise should internationalize to their country of origin, Germany, and create a cash cow to acquire some cash flow for the development of the main product. The entrepreneurs of CAN1, CAN2, NZ1 and NZ2 focused on applying for finance from different national and regional development programs, private owners, and venture capitalists in their home countries. FIN1's entrepreneur had a family-owned firm and did not apply for funding from anywhere. Hence, domestically based family ownership seems to make the approach to financiers very different from that of other entrepreneurs. Altogether, the financing base of these case entrepreneurs had a strong national focus, which is rather surprising given that the network ties overall including the market place were international.

### ***Importance of network ties***

Universities and research institutes played a very important role in the early activities of all entrepreneurs (CAN1, CAN2, FIN1, FIN2, and NZ2) except for NZ1's entrepreneur, who entered extensive research cooperation at a later phase of the company's existence. The entrepreneur of NZ1 started to collaborate with universities when a leading European scientist came to New Zealand and discovered huge potential for the product and started promoting the enterprise in Europe. For NZ1's entrepreneur, the European researchers and the EU research project were the main stepping stones to the market, but he did not engage in research collaboration with them.

For CAN1's entrepreneur, whose enterprise is currently in the very early phases of internationalization, the initial idea for their innovation had been generated in a local university, but the focus on university research was less extensive after launching the enterprise because the product was tested in a customer's business. Domestic customers played a very important role in the development of CAN1, CAN2, and NZ1, whereas in the case of NZ2 the focus of the entrepreneur was on international customers.

For the entrepreneurs of FIN1 and FIN2, domestic or international customers were not important in their business development at any stage. Both domestic and international sales channels and partnerships were regarded as very important by the entrepreneurs of CAN2, FIN1 and FIN2, whereas the focus of the entrepreneur of NZ1 was only on domestic sales channels and partnerships, and that of NZ2's only on international sales channels and partnerships. NZ2's entrepreneur explains the company's challenges in its main, saturated and regulated U.S. market: It required a long search for a good partner and our first partner development there actually failed. With the current one following several visits and contacts, they have finally agreed to really work with us, which has been a highly important milestone.

## Discussion and conclusions

This multiple-case study examined six biotechnology entrepreneurs from three different country contexts. The main contribution lies in synthesizing and applying existing conceptual insights from the literature to provide a more culturally sensitive view of getting embedded for international entrepreneurship in the biotech industry (Anderson and Jack 2002; Anderson, Dodd, and Jack 2010; 2012; Cappelli and Sherer 1991; Evers and O’Gorman 2011; Hoang and Antoncic 2003; McKeever, Anderson, and Jack 2014; McKeever, Jack, and Anderson 2015; Welter 2011). In addition, we recognize the networking practices of internationalizing biotech entrepreneurs, which allows us to understand the social dynamics of internationalization. Also, the views of type, locality, strength and importance of networks permit us to see more clearly the approaches that entrepreneurs take to achieve their internationalizing goals.

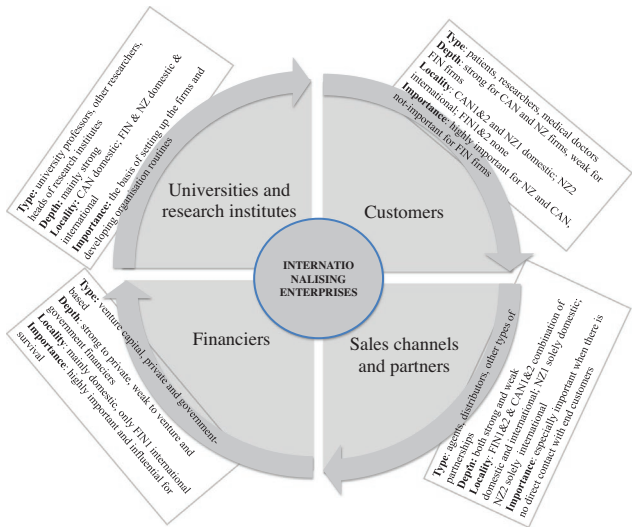
Figure 1 summarizes the embeddedness of the six entrepreneurs from the perspectives of (i) type, (ii) strength, (iii) locality, and (iv) importance of the international and national network ties among the case entrepreneurs in their early internationalization. All entrepreneurs were embedded in networks with (i) universities and research institutes, (ii) customers, (iii) sales channels and partners, and (iv) financiers, but the importance, strength, and locality in relation to them showed both similarities and differences as to the three different country settings under study. We found that for Finnish and New Zealand entrepreneurs, collaboration with both domestic and international research institutions was prevalent, whereas the Canadian entrepreneurs relied on solely local research institutes. In addition, we found differences in relation to customer focus in internationalization. While customers were central to the embeddedness of Canadian and New Zealand entrepreneurs, Finnish entrepreneurs had no focus on their customers, but acted solely through sales channels and partners. The customer focus of New Zealand entrepreneurs was mainly international, whereas it was domestic in the case of Canadian entrepreneurs. One explanation as to why Canadian entrepreneurs are more reliant on domestic customers than entrepreneurs in Finland or New Zealand could be attributed to size of the domestic market. As Casey and Hamilton (2014) found in their study of New Zealand small firms, it is the small size of the domestic market that encourages them to seek growth opportunities through international customers. In relation to financiers, on the contrary, we discovered they had similar influences on the enterprises in all three contexts. If enterprises were owned by venture capitalists, they had a significant influence on the strategy of the enterprise and had been difficult to persuade in providing finance, whereas private ownership enabled management to take the enterprise in their own desired direction. Consistent with Audretsch and Feldman (2003), our findings suggest that entrepreneurs are sometimes forced to enter unattractive agreements with venture capitalists in order to keep the business afloat. Figure 1 summarizes the embeddedness of the entrepreneurs in relation to the four investigated themes.

Analytically, in relation to the types and importance of ties, the findings suggest that universities and research institutes are very significant ties for these entrepreneurs, since they serve as the starting point for them to understand the markets and collaborate with specialists in the industry. Although it is known that partnering with academic institutions is key for these enterprises (e.g. Andersson, Evers, and Griot 2013; Evers and O’Gorman 2011; Rasmussen et al. 2011), our evidence additionally suggests that they are also crucial links in helping biotechnology entrepreneurs develop their own durable organizational routines.

In this light, our evidence contradicts Powell's (1998) finding that did not identify such an important role for networks for biotech enterprises. While Andersson, Evers, and Griot (2013) study is based on the medical technology regional cluster; our findings are similar, as we also demonstrate that internationalization, growth and innovation were strongly intertwined.

Overall, the evidence suggests that embeddedness for biotechnology entrepreneurs has strong elements of both social and business networking; the two seem to coexist and reinforce one another in the four types of networks we identified. The role of research-oriented networks decreased and the role of sales-oriented networks (customers and sales channels and partners) increased in importance over time.

Furthermore, another finding that is idiosyncratic to the biotech sector is that financiers constitute significant network ties who, on the one hand, can be affected and persuaded by the entrepreneurs' existing customers but, on the other, dictate specific changes or adaptations to the product offerings in order to commence or continue the provision of funding. We discovered similar influences by financiers in all the three country contexts. In the cases where the enterprises were owned by venture capitalists, they had a significant influence on the strategy of the enterprise, and the process of persuading them to offer finance had been difficult, whereas private ownership enabled taking the enterprise into a direction that matched the expectations of management. In this light, financiers act as effective gatekeepers and value co-creators in these biotech enterprises. This evidence adds to the existing literature that has solely suggested that financiers encourage the internationalization of enterprises (Humphery-Jenner and Suchard 2013). In addition, we found that the reputation of the relationships they reside in provides credibility for entrepreneurs to obtain valuable resources (Stinchcombe 1965; Zimmerman and Zeitz 2002). We highlight how entrepreneurs use these relationships to prove their reliability when they approach financiers for funding. Such relationships also help to overcome the risk assessment hurdles that small enterprises experience, especially in the biotechnology industry when approaching potential financiers (Audretsch and Feldman 2003).



**Figure 1.** Embeddedness of Canadian, Finnish and New Zealander biotech entrepreneurs for internationalization in relation to type, strength, location and importance of various network ties.

In relation to the locality and strength of ties, the evidence indicates that domestic ties seem to be quite strong and important, albeit their intensity varied at the early vs. later stages of network embeddedness. The Finnish and New Zealand entrepreneurs collaborated with both local and international universities and research institutions, whereas the Canadian entrepreneurs relied solely on local universities and research institutes. Initially, domestic ties with research institutions were of paramount significance, but the subsequent focus varied. The importance of customers was also mixed. While customers were central to the embeddedness of Canadian and New Zealand entrepreneurs, Finnish entrepreneurs did not focus on customers, but relied solely on sales channels and partners, both nationally and internationally. The customer focus of New Zealand entrepreneurs was mainly international, whereas for Canadian entrepreneurs it was domestic. There was no evidence of strong networking embeddedness with customers, as the scant literature on internationalized biotechnology entrepreneurs suggests (Renko 2011).

Interestingly, there was no common pattern of embeddedness relating to the country context of the entrepreneur. Thus, entrepreneurs from all three countries had dissimilar levels of ties with both local and foreign partners. In this light, these findings corroborate previous ones attesting to the ubiquitous nature of ties and the collaborative pattern of networking embeddedness that transcends domestic and international borders (Galkina and Chetty 2015; Zucchella and Kabbara 2011). However, this is in line with the findings of Andersson, Evers, and Griot (2013), which show that domestic ties were essential for INVs in the early phases of internationalization, but in later phases they tend to focus more on international ties.

In general, the findings of this study confirm that the biotech industry for entrepreneurs operating in domestic and international settings is distinguished by idiosyncratic networking embeddedness patterns. Research institutions and financiers appeared to be significant network ties, but the role of customers in both domestic and international contexts varied and showed context-specific differences. In addition, the locality and strength of ties varied across entrepreneurs and over time. Such situational variations add to network theory by suggesting that the context can significantly enrich traditional theories used in entrepreneurship (Zahra 2007). The evidence of the current study also confirms the view that investigation of the context can greatly rejuvenate thinking and theorizing in internationalization studies (Delios 2016). To some extent the context shaped all the network approaches present in the study, but there was still individual variation in each geographic context. Further studies from different geographical contexts are needed because we are in the very early stages of understanding the true complexity of the relationship between entrepreneurship and context.

This study has significant lessons for management practitioners. The evidence highlights the importance of four different types of relationships for entrepreneurs to access resources and combine knowledge. Biotech entrepreneurs must continuously seek new partners to enter and embed themselves in new networks, but simultaneously maintain and build strong ties that would be useful in pursuing international opportunities. In particular, entering new international networks can provide them with the chance to gain legitimacy and build a global reputation. While a relationship is likely to promote internationalization, it may also become a weakness, possibly creating obstacles to the enterprise's growth. Entrepreneurs need to develop the ability to learn from their networking experiences and thereby improve their networking capabilities, becoming better able to decipher how relationships are

evolving. In short, this study calls for appropriate network relationship management in the biotechnology sector. This would allow entrepreneurs to know when to reactivate latent relationships, and when to exit problematic ones, without destabilizing the enterprise.

There are several avenues to extend this research into different areas of inquiry. We outline four in this section. First, the study could be replicated in other geographical settings, including developed countries and developing economies. Secondly, the performance aspect could also be studied by examining the type and strength of the network relationships used, and the impact of these aspects on the international performance of the enterprise. Thirdly, the institutional environment and social context may be examined closer in future research. In the context of the economic development of a country, the institutional environment can affect the parties with whom relationships are formed, the importance of the relationships, and the creation of opportunities within different types of relationships. Fourthly, future research could delve deeper into the individual level, seeking to explain how entrepreneurs use their previous experience, social setting, reasoning and logic (Jones and Casulli 2014; McKeever, Anderson, and Jack 2014) in order to network effectively.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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